Rejection of Claims 1 and 3-7

In items 4-17 on pages 2-5 of the Office Action the Examiner rejected claims 1 and 3-7 under 35 U.S.C. § 103 as unpatentable over U.S. Patent 5,167,444 to Hall in view of the publication entitled "Temperature Independent Interferometer for WDM Filters" by Shirasaki.

U.S. Patent 5,167,444 to Hall

The Hall patent is directed to an apparatus and method for optical signal source stabilization. Figure 2 of Hall illustrates an interferometer 20 having three discs 36, 37 and 38 and a ring 40 formed of a material having a low coefficient of thermal expansion. The three discs 36, 37 and 38 as well as the ring 40 are formed of a glass ceramic composite material. The glass ceramic material includes a first component having a positive coefficient of thermal expansion and a second component having a negative coefficient of thermal expansion (column 4, lines 31-48).

Hall discloses stabilizing a frequency of an optical signal output from an optical signal source by polarizing the optical signal output from the optical signal source to direct the polarized optical signal to a Fabry-Perot interferometer, and controlling the optical signal source so that light selected after transmitting through the Fabry-Perot interferometer is maintained.

The Shirasaki Publication

The Shirasaki publication is directed to a method for eliminating the temperature dependence of an interferometer such as a Fabry-Perot etalon. Referring to Figure 3, Shirasaki discloses that temperature dependence of an optical distance is reduced by forming the interferometer such that a thin glass plate having anti-reflection coatings is sandwiched between thick glass plates having larger thermal expansion coefficients than the thin glass plate. The Shirasaki publication appears to be related to cited U.S. Patent 5,982,488 to Shirasaki.

The Present Claimed Invention Patentably Distinguishes over the Prior Art

The purpose of the Hall patent and the Shirasaki publication is to reduce the temperature dependency of the transmission wavelength characteristic of a Fabry-Perot interferometer. In contrast, the present invention is directed not only to reducing but also to increasing the

temperature dependency of the transmission wavelength characteristic. In the present invention, by setting the thicknesses and coefficients of expansion of the claimed first and second parallel members appropriately, it is possible to flexibly adjust (i.e., increase or decrease) the temperature dependency of the transmission wavelength characteristic of the etalon.

Claim 1 as amended recites features relating to increasing the temperature dependency of the transmission wavelength characteristic.

In the prior art etalons disclosed by the cited references, the thickness and coefficient of thermal expansion for each part of the etalon is set so that the change in the transmission wavelength characteristic corresponding to the thermal change is very small. Therefore, when a light with a large temperature dependency is input, it is difficult to compensate for the temperature dependency of the input light, since the transmission wavelength characteristic will have only a small change corresponding to a thermal change. In contrast, in the etalon of the present invention, it is possible to compensate for the temperature dependency of the input light.

Referring to claim 1 as amended, it is submitted that the prior art, either taken alone or in combination does not teach or suggest an airgap type etalon "wherein a distance between the parallel flat surfaces and the expansion coefficient of each of said first and second parallel members, are set to obtain temperature dependency of a transmission wavelength characteristic capable of compensating temperature dependency of incident light." Therefore, it is submitted that claim 1 patentably distinguishes over the prior art.

Claims 3 and 4 depend from claim 1 and include all of the features of that claim plus additional features which are not taught or suggested by the prior art. Therefore, it is submitted that claims 3 and 4 also patentably distinguish over the prior art.

Referring to claim 7 the Examiner stated that this claim sets forth a temperature dependency of the transmission wavelength characteristic which is "25 pm/°C or less." However, it is submitted that claim 7 recites "25 pm/°C or more." This feature is not taught or suggested by the prior art.

Rejection of Claim 2

In items 18-22 on pages 6 and 7 of the Office Action the Examiner has rejected claim 2 under 35 U.S.C. § 103 as unpatentable over the Hall patent in view of the Shirasaki publication

and further in view of U.S. Patent 5,982,488 to Shirasaki.

Claim 2 depends from claim 1 and includes all of the features of that claim, plus additional features which are not taught or suggested by the prior art. Therefore, it is submitted that claim 2 patentably distinguishes over the prior art.

New Claim 14

New claim 14 is directed to an airgap type etalon in which:

> "the distance between the parallel surfaces and the expansion coefficient of each of said first and second parallel members being set so as to produce an increase temperature dependency of a transmission wavelength characteristic which is capable of compensating for a temperature dependency of light incident to said airgap type etalon."

Therefore, it is submitted that claim 14 patentably distinguishes over the prior art.

Summary

It is submitted that none of the references either taken alone or in combination teach the present claimed invention. Thus claims 1-4, 7 and 14 deemed to be in condition for allowance. Reconsideration of the claims and an early notice of allowance are earnestly solicited.

Respectfully submitted,

STAAS & HALSEY LLP

Date: 5-16-03

By: _____
John C. Garvey
Registration No. 28,607

700 Eleventh Street, NW, Suite 500
Washington, D.C. 20001
(202) 434-1500

VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE SPECIFICATION:

Please AMEND the paragraph beginning at page 4, line 35 to page 5, line 10, as follows:

Meanwhile, the etalon described and established in Japanese Unexamined Patent Publication No. 7-27943 has a constitution in which a solid type etalon and an airgap type etalon are combined with each other. If the temperature [has rised] rises, the optical thickness (coherence length) of the solid type etalon is increased due to the thermal expansion and the increase of refractive index thereof while the optical thickness of the airgap type etalon is decreased so as to offset such an increased optical thickness, to thereby eventually maintain the total optical thickness of the etalon to be constant. Even in such a constitution, however, it is difficult to realize an etalon having a higher wavelength-temperature characteristic, and there is such a defect that the degree of design freedom of the wavelength-temperature characteristic is restricted as described above due to the partial inclusion of the solid type etalon.

Please AMEND the paragraph beginning at page 12, lines 35-36 as follows:

wherein: R is reflectance of a reflection coating, n is [an] a refractive index of the gap, d is a physical distance of the gap, and θ is an incident angle of light.

Please AMEND the paragraph beginning at page 14, lines 9-22, as follows:

[Contrary] In contrast, in the airgap type etalon 1 of this embodiment of the present invention as shown in FIG. 1, Fabry-Perot interference is formed within the airgap between the reflection augmenting coating 3B on the transparent parallel flat plate 3 and the reflection augmenting coating 5B on the transparent flat plate 5. However, this etalon 1 noway includes such a constitution to interpose a gap material between two sheets of flat plates 3 and 5, and rather the transparent parallel flat plate 3 (thickness d_1, linear expansion coefficient α_1) and the parallel flat plate 4 (thickness d_2, linear expansion coefficient α_2) thicker than the plate 3 by "d" are fixed to each other, on the basis of the flat surface of the fixing block 2 as a reference surface so that the airgap length is the difference $d=d_2-d_1$ between the thickness of the flat plate 3 and the thickness of the flat spacer 4. Thus, even when the airgap length d has been determined by the required optical characteristics, the thicknesses d_1, d_2 can be freely varied,

and the linear expansion coefficients α_1, α_2 of the flat plate 3 and flat spacer 4 serve as design parameters, respectively.

Please AMEND the paragraph beginning at page 31, lines 17-25, as follows:

In the wavelength characteristic varying apparatus 30, the temperatures of the optical filters 33A, 33B have been controlled to be the same, by one thermal detector 34 and one thermal controlling element 35. However, it is also possible to separately control the temperatures of the optical filters 33A, 33B, such as by providing the optical filters 33A, 33B with respective thermal detectors and thermal controlling elements. In this situation, airgap type etalons having identical wavelength shift directions can be adapted as the optical filters 33A, 33B such that the temperatures of the optical filters 33A, 33B are controlled in the opposite [directionsto] directions to each other.

IN THE CLAIMS:

Please AMEND the claims in accordance with the following:

1. (ONCE AMENDED) An airgap type etalon comprising:

a fixing member having at least one flat surface;

a first parallel member, which is transparent to incident light and has parallel flat surfaces, one of said parallel flat surfaces thereof being joined to said flat surface of said fixing member;

at least one second parallel member, which has parallel flat surfaces in which a distance between said parallel flat surfaces thereof is greater than a distance between said parallel flat surfaces of said first parallel member, and has an expansion coefficient different from that of said first parallel member, one of the flat surfaces of said second parallel member being joined to said flat surface of said fixing member so as to surround the outer periphery of said first parallel member; and

a transparent member, which is transparent to incident light [into] and has opposite flat surfaces, one of said flat surfaces thereof being joined to the other flat surface of said second parallel member, said other flat surface being opposite to the joined surface to said fixing member;

wherein a Fabry-Perot interferometer is formed based on an airgap positioned

between the flat surface of said first parallel member and the flat surface of said transparent member facing each other, and wherein a distance between the parallel flat surfaces and the expansion coefficient of each of said first and second parallel members, are set to obtain temperature dependency of a transmission wavelength characteristic capable of compensating temperature dependency of incident light.

7. (ONCE AMENDED) An airgap type etalon of claim [5] 1, wherein temperature dependency of said transmission wavelength characteristic is set to be 25pm/ °C or more and an expansion coefficient.

IN THE ABSTRACT:

Please AMEND the abstract as follows:

ABSTRACT

[The present invention aims at providing an] An airgap type etalon [having] has a higher degree of design freedom of a wavelength-temperature characteristic so that such a wavelength-temperature characteristic can be freely adjusted[, and at providing an apparatus utilizing such an etalon]. [To this end, the] The airgap type etalon [of the present invention is constituted to comprise:] includes a fixing block having one flat surface[;], and a transparent parallel flat plate having parallel flat surfaces formed with an antireflection coating and a reflection augmenting coating thereon, respectively[, the]. The flat surface at the antireflection coating side [being] is joined to the flat surface of the fixing block[; a]. A parallel flat spacer [having] has a thickness greater than that of the transparent parallel flat plate and an expansion coefficient different from that of the transparent parallel flat plate[, one]. One of the flat surfaces of the parallel flat spacer [being] is joined to the flat surface of the fixing block[; and a]A transparent flat plate [having] has opposite flat surfaces formed with an antireflection coating and a reflection augmenting coating thereon, respectively[, the]. The flat surface at the reflection augmenting coating side [being] is joined to the other of the flat surfaces of the parallel flat spacer[;], wherein a Fabry-Perot interferometer is formed based on an airgap positioned between the flat surface of the transparent parallel flat plate and the flat surface of the transparent flat plate, which flat surfaces face [to] each other.